A Renewed Push for Ethanol, Without the Corn
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Cheryl Gerber for the New York Times
Russell Heissner, a biofuels expert in Jennings, La., in front of a mound of bagasse, a sugar cane waste product used to make ethanol.

The sun shone brightly on the crowd gathered at the rusting old oil refinery here, as company officials showed off diagrams explaining how they planned to turn weeds and agricultural wastes into car fuel.
Government officials gave optimistic speeches. In the background, workers prepared a new network of pipes, tanks and conveyor belts.

That was in October 1998, when ethanol from crop wastes seemed to be just around the corner.

It still is. Last February, company officials gathered here once again, to break ground on a plant designed to make ethanol by yet another method.

At the time of the first ceremony, the Energy Department was predicting that ethanol produced from cellulosic waste would be in the market by about 2009 in the same volume as ethanol from the conventional source, corn.

But no company has yet been able to produce ethanol from cellulose in mass quantities that are priced competitively with corn-based ethanol. And without the cellulosic ethanol, the national goal for ethanol production will be impossible to reach.

“Producing cellulosic ethanol is clearly more difficult than we thought in the 1990s,” said Dan W. Reicher, who was assistant secretary of energy efficiency and renewable energy at the time of the first ceremony and who spoke here then.

To be sure, swarms of innovators, venture capitalists and government officials are optimistic. Over the last year, money has begun to pour in from all corners — government, private foundations, venture capitalists and Wall Street — to sort out the myriad production problems preventing cellulosic ethanol from becoming a reality. And recent advances in gene sequencing have raised hopes for a breakthrough in mass producing the enzymes needed to do the work.

If making the technology work to produce ethanol from cellulose was important in the 1990s, it is even more critical now. Because of growing concerns about oil imports and climate change, Mr. Reicher said, “it is essential that we figure this out, and fast.”

Mounting concerns over excessive demands for corn as both food and fuel only add to the urgency. In January, President Bush set a goal of producing 35 billion gallons of alternative fuels, probably mostly ethanol, by 2017.

But the more than six billion gallons of ethanol that will be produced this year have already helped push corn to its highest price in years, raising the cost of everything from tortillas to chicken feed. Poor people in Mexico have protested against the higher prices, and now China and India are starting to suffer from food inflation.

So why has no one figured out a way to make ethanol from materials like the sugar cane wastes engineers are working with here?

In fact, engineers at several companies have done that — but only at the lab level. One company, Iogen, has a pilot plant running in Ottawa and hopes to build a larger operation soon.

Abengoa, a Spanish company, says it plans to open a plant in northern Spain late this year, and wants to build a factory in Kansas. Broin Companies, of Sioux Falls, S.D., is planning to expand a corn ethanol plant in Emmetsburg, Iowa, to use cellulose as well.

But everyone is still struggling to develop a method that is cost competitive with corn ethanol — not to mention competing with gasoline and other fuels from oil without subsidies.

The pilot plant that opened here in 1998, after the first ceremony, “worked like a charm,” said Russell Heissner, a biofuels expert at Celunol, the company building the Jennings plant. But Celunol, then called BC International, shut it after a few months because of a lack of money and because it could not figure out how to turn the process into a commercial-scale project.

Now the company is building a much larger plant to tackle another part of the cellulosic puzzle.

The broad concept is the same everywhere. Yeast is used to turn sugar into alcohol, a process learned thousands of years ago. The easiest way to get sugar is from sugar cane. Corn provides carbohydrates, long chains of starch that are easily broken into sugars.

Mr. Heissner is hopeful that stems, stalks, wood chips and other materials will replace the corn. The founding brew master at Harpoon, a Boston beer brand, Mr. Heissner later designed and built microbreweries and pubs.

That experience is relevant. Beer is made from barley, a seed, or cereal grain, like corn. It is exposed to warmth and moisture that resemble the conditions for germination, and the barley begins to produce an enzyme that converts its starch into sugar. The brew master roasts the barley to kill the plant, but the enzyme continues to convert the starch to sugar. Hops are added for flavor, and then yeast is added to convert the sugar to alcohol.

Cellulose is also made up partly of sugars, but they are linked tightly in a more complicated chain. Breaking them up requires several enzymes. Most processes start with using steam and sulfuric acid on the feedstock, which can be corn stems and leaves, switch grass, wood chips — or bagasse, the material left when sugar cane is processed and which is being used here in Jennings.

Manufacturers rely on a variety of organisms to make the necessary enzymes. They are the product of gene splicing, turning out enzymes in quantities far greater than any natural organism would.

Unlocking the sugar represents a gold mine. Mark Emalfarb, the president and chief executive of another competitor, Dyadic, said corn now makes up about half the price of corn ethanol, while some cellulosic materials are free, beyond the cost to haul them to a factory.

But the enzymes needed to break corn starch into sugar are cheap, costing 3 to 5 cents a gallon of ethanol. His goal for the enzymes that work on cellulose is 10 cents a gallon, but it does not appear that anyone has gotten the cost anywhere near that low yet.

“Some people are still underestimating how difficult it is going to be,” Mr. Emalfarb said.

The Energy Department has set a goal of bringing down the overall cost to produce cellulosic ethanol to $1.07 a gallon by 2012. That is less than half the cost of producing it now and lower than the current cost of about $1.50 a gallon for corn-based ethanol.

“Anybody’s number is just basically a guess,” said Brent Erickson, executive vice president at the Biotechnology Industry Organization in Washington. “Until we get these plants built, we aren’t going to know what the cost is.”

The race to commercialize cellulosic ethanol has been helped by the recent flood of investment from public and private sources.

The Energy Department has devoted $726 million for renewable energy projects this year, including wind and solar energy. It recently awarded grants totaling $385 million over four years to six companies working on cellulosic ethanol plants. The Agriculture Department is seeking to increase its bio-energy financing to $161 million from $122 million, which would include $21 million in loan guarantees for cellulosic plants.

Venture capital firms, Wall Street banks and even oil companies have invested about $200 million in the last six months alone.“There is nothing in the last several decades that has generated such private sector enthusiasm and investment,” said Keith Collins, the Agriculture Department’s chief economist.

The investment is risky but the potential benefits are enormous. A cellulosic ethanol process would raise the ethanol yields from sugar cane by about one-third an acre by using parts of the sugar plant that are now thrown away as waste. For corn wastes, the number is similar.

The cellulosic process also promises to use less energy than corn-based ethanol. And it can work on material that is not currently considered a crop, like switch grass or wood chips left over from paper making.

In Louisiana, Celunol is experimenting with an aboriginal sugar cane that grew 200 years ago, before farmers started selectively breeding for the varieties with more sugar. Native to the local environment, “it doesn’t need fertilizer and it grows everywhere, like weeds,” said Matthew Gray, a research engineer with the company.

Mr. Heissner, who studied viniculture and enology at the University of California, Davis, said he was happy to move from microbreweries to vehicle fuel, which would be a much bigger business, he predicted.

Andrew Karsner, the current assistant secretary for energy efficiency and renewable fuels, said that he agreed. The original Jennings project, despite its earlier failures, was simply “well ahead of the killer wave that is here with us now.”

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